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Downsizing and Productivity Gains in the Public and Private Sectors of Colombia

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Abstract

Public sector restructuring, including labor downsizing, has been one of the main areas of policy activism in developing countries and transition economies. But little is known about its actual effects. Rama and Newman use panel data on Colombian enterprises spanning more than one decade to assess the impact on several productivity indicators. The results suggest that the productivity gains from downsizing are larger in state-owned enterprises than in private enterprises. While the increase in value added per worker is similar in both cases, state-owned enterprises experience an increase in total value added, and in value added per unit of capital, whereas both indicators decline in private enterprises. The difference, which could simply reflect the larger extent of initial inefficiency in state-owned enterprises, does not appear to depend on the degree of competition in product markets.

This paper—a product of Public Services, Development Research Group—is part of a larger effort in the group to understand employment and pay issues in the public sector. Copies of this paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Hedy Sladovich, mail stop MC3-311, telephone 202-473-7698, fax 202-522-1154, email address hsladovich@worldbank.org. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The authors may be contacted at mrama@worldbank.org or cnewman@ers.usda.gov. January 2002. (32 pages)

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1. Introduction

Can state-owned enterprises be made more efficient? Many would argue that this is a hopeless endeavor in developing countries and transition economies. In their view, political considerations and insider power will always prevail. As a result, overstaffing, an inadequate skill mix, and ineffective work practices are unavoidable. From this perspective, the only prospect to increase the productivity of state-owned enterprises is to transfer them to the private sector. For others, however, the key to higher productivity is not ownership, but rather a competitive environment. Public sector restructuring would thus yield some promise if it were accompanied by increased competition in product markets and a harder budget constraint.

Regardless of the merits of these two views, it is clear that privatization is not always an option, at least not in the short run. Governments often want to retain control over industries that are allegedly "strategic." They can also be reluctant to divest because of the threat of political resistance by vocal stakeholders, including trade unions. Regulatory weaknesses and the potential for corruption and asset stripping in the privatization process may be powerful deterrents too. And even when governments are committed to divest, some restructuring may be needed in preparation for privatization. In many cases, dealing with labor redundancies is seen as prerequisite to attract private investors.

The restructuring of state-owned enterprises has been an important area of policy activism in developing countries and transition economies. This restructuring has often involved substantial employment cuts. In 1991–93 alone, Haltiwanger and Singh (1999)

identified 41 World Bank loans and credits indirectly supporting public sector downsizing operations in client countries. Of them, 15 were aimed at restructuring or privatizing state-owned enterprises. By a conservative estimate, a similar number of downsizing operations was supported by the World Bank during the rest of the 1990s. A World Bank memorandum issued in 1996 paved the way for the direct funding of separation packages for redundant workers, as opposed to the indirect support of the early 1990s, which was channeled through the government's budget. The 1996 memorandum justified lending for separation packages if the case could be made that labor downsizing would increase productivity.

However, measuring the productivity impact of enterprise restructuring in general, and of labor downsizing in particular, is not an easy task. In the private sector, the cheerful response of stock markets to restructuring or downsizing announcements suggest that this impact is positive. But it would be hazardous to assume that it is positive in the public sector as well. If political pressures and insider power lead to "wrong" recruitment decisions, they could also lead to "wrong" downsizing decisions (Rama 1999).

There are not many empirical studies on the productivity impact of downsizing, and most of them refer to the private sector. The pioneering paper in this literature, by Baily, Bartelsman, and Haltiwanger (1996), refers to manufacturing in the United States. It shows that plants that increased employment contributed as much to overall productivity growth as plants that reduced employment. Similar conclusions are reached by Lach (1999) for the manufacturing sector of Israel. Studies relying on more focused samples identify stronger effects. In a paper examining the performance of 118 U.S. firms, Espahbodi, John, and Vasudevan (2000) find that operating performance improves significantly following downsizing. Something similar happens in motor vehicle manufacturing in the United Kingdom, according to a study by Collins and Harris (1999). However, this study also finds that "unsuccessful" downsizers tend to have among the worst productivity growth rates.

The evidence is even thinner concerning downsizing in the public sector. In a study dealing with 281 privatization episodes in Mexico, La Porta and López-de-Silanes (1999) found that downsizing efforts prior to privatization did raise privatization prices, suggesting that the productivity impact was positive. But the estimated effect was barely significant. Another paper by Sheehan, Morris, and Hassard (2000), more descriptive in nature, dealt with redundancies in Chinese state-owned enterprises. It found that the potential political repercussions of job losses hindered the freedom of management to adjust employment levels in the interest of efficiency, which suggests that downsizing could increase productivity. But this is a conjecture.

Another line of research has emphasized the impact of competitive pressures on public sector productivity. State-owned enterprises would not be able to keep outdated work practices, or poor monitoring, if their survival was at stake. Inefficiencies of this sort could only last in enterprises that enjoy some monopoly power, or are subject to a soft budget constraint. While many state-owned enterprises are sheltered from competitive forces, those that are not should exhibit productivity levels that are close to those of the private sector, despite being state owned. Bartel and Harrison (2000) provide some evidence supporting this view in the case of Indonesia. Based on their findings, it would be tempting to conclude that public sector downsizing could increase productivity if it were to take place in a competitive environment. But again, this is a conjecture.

In the absence of more systematic results, estimates of the impact of labor downsizing on public sector productivity usually rely on more or less arbitrary assumptions. One common, extreme assumption, is that the marginal productivity of all separated workers is zero. At the other extreme, it can be assumed that state-owned enterprises operate on their technological frontier, their only source of inefficiency being the excessive number of workers per unit of capital. In this case, the marginal productivity of redundant workers would be lower than their marginal cost to the enterprise, but it would still be positive.

Assumptions of this sort cover too broad a range to provide reliable estimates. In an assessment of public sector downsizing in Algeria, Ruppert (1999) showed that the economic returns to labor downsizing could vary from strongly positive in one extreme case to strongly negative in the other one, hence the need for more accurate estimates.

This paper exploits a unique plant-level data set to estimate the actual impact of labor downsizing on public sector productivity in a developing country, namely Colombia. This data set, which includes almost 80,000 observations, has a panel structure and spans more than a decade (1977–1991). Over that period, Colombia experienced sustained economic growth but did not embark in a privatization program. Many enterprises undertook a restructuring of their activities, sometimes involving substantial employment cuts. The extent and persistence of these cuts is used in the paper to identify several hundred downsizing episodes, many of which affected state-owned enterprises. Taking advantage of the panel nature of the data set, the paper then estimates the impact of downsizing on several productivity indicators. This impact is systematically compared across privately- and state-owned enterprises, taking into account the extent of competition in product markets.

2. The Analytical Framework

Most studies on the impact of restructuring on productivity focus on the entry and exit of enterprises or plants. This turnover process is often labeled "external" restructuring, as opposed to the "internal" restructuring that takes place in continuing enterprises. Productivity gains from "internal" restructuring are often computed as a residual, much the same as total factor productivity gains in macroeconomic growth accounting. "Internal" restructuring is thus treated as a continuous process, rather than as a discrete change. Decompositions of productivity growth along these lines can be found in the studies by Davis, Haltiwanger, and Schuh (1996) for the United States, and by Disney, Haskel, and Heden (2000) for the United Kingdom. A similar approach is applied in the studies collected by Roberts and Tybout (1996) to a series of developing countries, including Colombia.

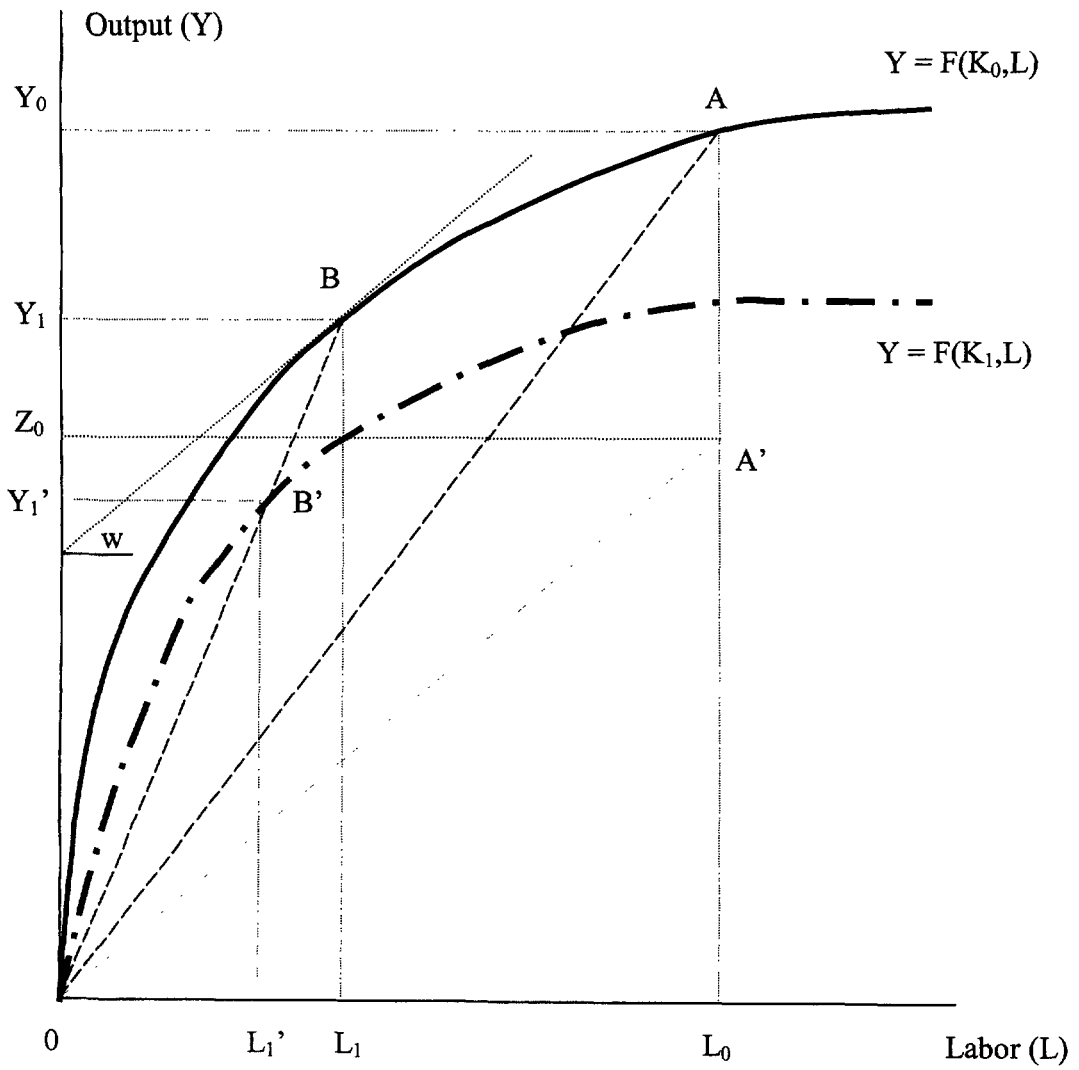
The approach in this paper, on the other hand, identifies restructuring efforts based on changes in employment at the plant level. This approach has some similarity with the one applied by Baily, Bartelsman, and Haltiwanger (1996) to the analysis of productivity in U.S. manufacturing. Baily and others compare plants whose employment level increases to plants whose employment level decreases between 1977 and 1987. The former are identified as "downsizers" and the latter as "upsizers." However, minor changes in employment over a decade may not reflect any major restructuring effort. This is why our paper relies on a critical downsizing threshold. Only plants whose employment reduction exceeds this threshold in any given year, and is at least partially sustained during the following year, are considered downsizers.

The focus on employment cuts that are not only large, but also sustained, is warranted to deal with measurement error bias. Productivity is often measured in units of output (say, value added) per worker. But employment is measured imperfectly. Consider the case where the number of workers reported for a specific plant in a specific year falls below the actual level. For instance, one digit could be missing in the reported data. Assume also that value added is correctly measured. This plant could be considered a downsizer, and it would also appear to experience a substantial increase in value added per worker. However, measurement error is presumably uncorrelated over time (missing digits are more or less randomly distributed in the sample). If this is so, the apparent reduction in employment would not be sustained over time, and the plant should not be considered as a downsizer.

The potential effects of downsizing on productivity are illustrated by Figure 1. The bold solid line in this figure is a standard production function, linking the labor input L to the output level Y for a given capital stock K_0. The initial equilibrium, represented by point A, is one where the enterprise is overstaffed. At the prevailing wage level w, profits are maximized when

employment is equal to L_1. In graphical terms, the optimum for the enterprise is represented by point B, where the marginal productivity of labor is equal to its cost. Moving from A to B entails a reduction in total output (from Y_0 to Y_1). If the capital stock remains unchanged, there is also a proportionate decline in output per unit of capital. But output per worker increases. This is reflected in the steeper slope of 0B, compared to 0A.

Figure 1. Downsizing and Productivity



This simple analysis requires two qualifications. First, it assumes that the capital stock remains unchanged, whereas actual restructuring efforts may also involve discarding outdated equipment, or introducing new technologies. Consider the simplest example, where an obsolete line of production is shut down. In this example, the reduction in employment is associated with a reduction in the capital stock from K_0 to K_1. Because of the smaller capital stock, the production function shift downwards, as reflected by the bold broken line in Figure 1. The new equilibrium could be represented by a point like B'. Because of the smaller capital stock, the optimal employment level is lower than in the previous example, and the decline in total output is larger. The increase in output per worker can be either larger or smaller depending on technology. Figure 1 corresponds to the case where output per worker is the same in B and B'.

The second qualification refers to the nature of the initial inefficiency. In point A, the enterprise is overstaffed but makes the best possible use of its personnel. Point A lies on the production function indeed. However, the initial situation could be one where the enterprise is not only overstaffed, but also fails to exploit its technological possibilities, as in point A'. By shedding its excess labor, and reorganizing production so as to take full advantage of its resources, the enterprise could move from point A' to point B. This move could be associated with an increase in total output (from Z_0 to Y_1), and a corresponding increase in output per unit of capital. There would also be a substantial increase in output per worker, because productivity in the initial equilibrium was abnormally low (the line 0A' was flatter than the line 0A).

The discussion in the previous paragraphs has implications for the measurement of productivity gains. Many studies focus on total factor productivity growth, i.e., on the change in output that is not accounted for by changes in capital and labor inputs. But this calculation requires that all changes be measured in comparable units. Typically, changes in inputs are multiplied by indicators of their marginal productivity. Thus, for instance, the change in employment is multiplied by the average labor cost per worker. However, this approach implicitly assumes that resources are been used efficiently, which is inconsistent with the need for restructuring. Point A in Figure 1 is characterized by a marginal productivity of labor below the labor cost w. And the gap is even larger in point A'. Under these circumstances, attaching weights to the changes in capital and labor inputs involves some arbitrariness.

Rather than trying to compute total factor productivity, this paper relies on the three indicators considered in the discussion of Figure 1. These are total output (Y), output per unit of labor (Y/L), and output per unit of capital (Y/K). Enterprise restructuring in general, and labor downsizing in particular, may lead to changes in all three. Using lowercase letters for logs, productivity gains in plant "i" and year "t" can be defined as follows:

$$dy_{i,t} = Log\,Y_{i,t} - Log\,Y_{i,t-1} \quad (1)$$

$$d(y/l)_{i,t} = \left(Log\,Y_{i,t} - Log\,Y_{i,t-1}\right) - \left(Log\,L_{i,t} - Log\,L_{i,t-1}\right) \quad (2)$$

$$d(y/k)_{i,t} = \left(Log\,Y_{i,t} - Log\,Y_{i,t-1}\right) - \left(Log\,K_{i,t} - Log\,K_{i,t-1}\right) \quad (3)$$

By construction, these three indicators are expressed in relative terms. For relatively small values they can be interpreted as percentages.

The paper compares productivity changes across plants, after classifying them along two dimensions: state owned versus privately owned, and downsizers versus nondownsizers. The simplest analyses describe the distribution of dy, d(y/l) and d(y/k) in each of the four groups resulting from this two-dimensional classification. More elaborate analyses control for other characteristics of the plants, such as their initial "size," the taxes and subsidies they are subject to, their sector of activity, or the province they are located in. These variables, as well as the year considered, are summarized by the vector $X_{i,t}$. Other important variables refer to the degree of competition in product markets, identified as $M_{i,t}$.

The basic specification used in the econometric analysis has the following form:

$$dy_{i,t} = \alpha_0 + \alpha_1 S_i + \alpha_2 D_{i,t} + \alpha_3 S_i D_{i,t} + \alpha_X X_{i,t} + \alpha_M M_{i,t} + \varepsilon_{i,t} \quad (4)$$

In this equation, S_i is a dummy variable equal to one if enterprise "i" is owned by the state, whereas $D_{i,t}$ is a dummy variable equal to one if enterprise "i" downsizes its workforce in year "t." The default case corresponds to a privately owned enterprise that does not downsize. Parameter α_1 measures the gap in productivity growth rates between state owned and privately owned enterprises in the absence of any downsizing. Parameter α_2 reflects the impact of downsizing on the productivity of privately owned enterprises, whereas parameter α_3 assesses whether this impact is different in the public and the private sectors.

Similar equations can be estimated replacing the explained variable dy by d(y/l), or by d(y/k). However, not all the variables in vector X can be retained in these other equations. This is because a spurious correlation could emerge between plant "size" indicators and productivity indicators. Plant size can be measured by Log $K_{i,t-1}$ and Log $L_{i,t-1}$. But the latter variable is used to compute d(y/l) (see equation 2), whereas the former is used to calculate d(y/k) (see equation

3). In the presence of measurement error, having the same variable in the left-hand side and the right-hand side of the equation can bias the estimates. Consequently Log $K_{i,t-1}$ is dropped from vector X when the left-hand side variable is d(y/k), whereas Log $L_{i,t-1}$ is dropped when the left-hand side variable is d(y/l).

A shortcoming of the specification in equation (4) is to ignore the potential impact of unmeasured plant characteristics on productivity growth. A common finding across studies is the importance of idiosyncratic factors in explaining differences in productivity across plants. If those idiosyncratic factors were correlated with any of the explanatory variables, estimating equation (4) by ordinary least squares would yield biased results. The availability of panel data makes it possible to overcome this problem, by letting the constant term in equation (4) be plant specific. This is the same as introducing a dummy variable for each enterprise. The drawback of the panel data approach is that parameter α_1 cannot be estimated anymore. This is because the dummy variable S_i is the sum of all the dummy variables for state-owned enterprises, so that there is perfect colinearity.

The specification used to exploit the panel nature of the data is the following:

$$dy_{i,t} = \beta_{0i} + \beta_2 D_{i,t} + \beta_3 S_i D_{i,t} + \beta_X X_{i,t} + \beta_M M_{i,t} + \nu_{i,t} \qquad (5)$$

This equation can be estimated using fixed effects. Again, similar equations can be estimated for d(y/l) and d(y/k), dropping from vector X the "size" indicators Log L_{t-1} and Log K_{t-1} respectively.

Finally, the paper also assesses whether a competitive environment affects the impact of downsizing on productivity. This is achieved by interacting the market characteristics M with the dummy variables S and D. Equation (4) can thus be rewritten as:

$$dy_{i,t} = \alpha_0 + \alpha_1 S_i + \alpha_2 D_{i,t} + \alpha_3 S_i D_{i,t} + \alpha_X X_{i,t} + \alpha_M M_{i,t} + \qquad (6)$$

$$+ \alpha_4 S_i M_{i,t} + \alpha_5 D_{i,t} M_{i,t} + \alpha_6 S_i D_{i,t} M_{i,t} + \varepsilon'_{i,t}$$

whereas equation (5) becomes:

$$dy_{i,t} = \beta_{0i} + \beta_2 D_{i,t} + \beta_3 S_i D_{i,t} + \beta_X X_{i,t} + \beta_M M_{i,t} + \tag{7}$$

$$+ \beta_4 S_i M_{i,t} + \beta_5 D_{i,t} M_{i,t} + \beta_6 S_i D_{i,t} M_{i,t} + v'_{i,t}$$

The key parameters to assess the impact of product market competition on the productivity gains from restructuring are α_4 to α_6 and β_4 to β_6.

3. The Manufacturing Sector in Colombia

Colombia is one of the few developing countries where the data needed to estimate equations (4) to (7) are available. The original source of these data is the census of manufacturing plants conducted by the Departamento Administrativo Nacional de Estadística (DANES). The census reports information on dozens of state-owned enterprises. Mark J. Roberts and James R. Tybout transformed the individual cross-section data sets into a panel, by matching plant records across survey rounds for 1977 to 1991. The matching was based on stable characteristics of firms, such as their initial year of operation and their location. It also involved information on inventories at the beginning and the end of the year (see Roberts 1996). As a result, between 87 and 92 percent of all enterprises were matched in any given year.

During the period covered by the data, the manufacturing sector enjoyed a stable macroeconomic environment and moderate growth. Unlike other Latin American countries, Colombia did not experience high levels of inflation or serious aggregate imbalances, and was not forced to implement fiscal reforms. Its approach to macroeconomic policy was gradualist and fiscally conservative, in accordance with the country's tradition. Public expenditures grew during the 1980s, but the level of taxation grew sufficiently to cover the growth in public expenditures. Public sector debt was relatively small, and average deficits were estimated as being only 1.5 percent of GDP (Carrasquilla 1996, and Galat 1998).

Microeconomic policies were relatively stable too. Trade policy went from a period of liberalization in the late 1970s to a protectionist period through most of the 1980s. The late 1970s witnessed a series of reductions in quantitative restrictions and nominal tariffs. But many of the restrictions were reintroduced in 1981 when a declining real exchange rate hurt exports and led to pressure to protect the import-competing domestic market. Export promotion stayed at levels that had been introduced in 1967 (Roberts 1996), so trade policy was focused on the import side. More significant trade liberalization did not occur until the early 1990s.

The size and scope of the public sector was diverse, including large industry and finance. The largest nonfinancial components were the nation's social security system, the state-owned petroleum company, the electricity and telecommunication sectors, the state-owned coal company, a large public transportation project in Medellín, and the national coffee fund. Most provincial governments also had a print shop and a rum brewery. There were some privatizations in the banking sector in the mid-1980s as a result of government intervention in an earlier banking crisis. But there was not a systematic attempt to divest state-owned enterprises (Zuleta 1993). Lack of privatization warrants the use of the time-invariant dummy variable S_i to identify state-owned enterprises in equations (4) to (7).

The total number of observations used in the analysis is 79,149. Among them, 12,761 correspond to enterprises appearing only once in the data. However, multiple observations of the same plant are common. The average number of times that an enterprise appears in the data is 9.5, and the median is 10. In a study covering the first nine years of the panel (1977 to 1985), Roberts (1996) found that the overall patterns of entry and exit were similar to those of industrialized countries. Most of the observations in the data set are located in the major metropolitan areas of Bogota, Cali, and Medellín. Enterprises are relatively small, as two-thirds of them employ less than 50 workers and only 8 percent have more than 200 workers. The distribution of observations by region, size, and number of appearances can be found in Table 1.

The characteristics of state-owned enterprises differ markedly from the overall sample. The corresponding number of observations is 494, of which 78 are from enterprises appearing only once in the data set. State-owned enterprises are located in more disperse areas of the country, with only one-third in the three major metropolitan areas. They are also much larger than private firms, with more than half of them employing 200 workers or more.

The distribution of observations by sector is shown in Table 2. State-owned enterprises are clustered in a few major activities: beverages, printing and publishing, food, petroleum derivatives, and transportation. Private enterprises are fairly evenly distributed across all sectors, with slightly heavier concentrations in food and clothing and shoes. On average, value added per worker is higher for state-owned enterprises, and value added per unit of capital is lower, but there are important differences by sector. Some of the sectors in which state-owned enterprises exist are among the more capital intensive and more concentrated. Beverages and petroleum derivatives are also industries where the state has a high proportion of market share.

Table 1. Sample Characteristics

	All enterprises	*State-owned enterprises*
Geographic Location	(*percent*)	(*percent*)
Bogotá D.E., Soacha	34.15	13.56
Cali, Yumbo	11.05	9.72
Medellín, Valle de Aburra	21.40	9.11
Manizales, Villamaría	1.60	4.66
Barranquilla, Soledad	6.79	1.82
Bucaramanga, Girón, Floridablanca	5.57	3.04
Pereira, Santa Rosa de Cabal, Dosquebra	2.74	
Cartegena	1.58	5.06
Rest of the country	15.13	53.04
Total	100.00	100.00
Plant size	(*percent*)	(*percent*)
Less than 20 workers	33.33	7.69
Between 20 and 50 workers	33.40	18.42
Between 50 and 100 workers	15.76	11.54
Between 100 and 200 workers	9.09	10.53
More than 200 workers	8.42	51.82
Total	100.00	100.00
Plants by number of appearances in data		
1 year	1,891	18
2 years	3,476	18
3 years	3,837	9
4 years	4,476	16
5 years	5,085	35
6 years	4,818	12
7 years	4,473	63
8 years	4,288	8
9 years	3,987	18
10 years	3,500	20
11 years	3,905	33
12 years	3,156	36
13 years	4,355	26
14 years	27,902	182
Total	79,149	494

Source: Constructed by the authors using data from the 1977 to 1991 rounds of the Colombian manufacturing census.

Table 2. Summary Statistics for Enterprises

	State-owned enterprises				*Private enterprises*			
Sector of activity	*Number of obser-vations*	*Workers per firm*	*Value added per worker*	*Value added per capital*	*Number of obser-vations*	*Workers per firm*	*Value added per worker*	*Value added per capital*
Food	62	133.9	65.1	5.5	13,507	72.2	82.1	11.4
Beverages	219	275.5	320.6	11.4	1,467	193.2	185.5	15.1
Tobacco					200	205.9	146.4	23.9
Textiles	12	35.3	45.7	1.2	5,479	136.0	46.6	16.8
Clothing and shoes					13,055	58.1	38.5	15.6
Leather goods except shoes					1,128	85.2	33.3	17.1
Wood and cork products					1,999	39.4	38.4	10.6
Wood furniture					2,186	44.1	27.0	13.4
Paper and paper products					1,780	84.3	104.9	17.4
Printing and publishing	86	73.7	16.0	2.9	4,019	65.6	28.0	7.7
Chemicals	3	23.3	53.6	2.1	5,158	104.7	145.8	24.5
Petroleum derivatives	41	1383.7	196.5	4.8	291	40.2	187.6	13.3
Rubber products					4,404	75.7	50.1	9.7
Nonmetallic minerals	9	29.6	14.6	6.5	4,676	94.3	51.0	144.7
Metals					1,111	172.0	98.7	6.4
Metal products					6,716	58.3	48.2	7.7
Nonelectrical machinery	1	30.0	433.0	18.8	3,790	52.8	100.3	11.0
Electrical machinery					2,478	94.9	85.7	8.0
Transport equipment	46	242.7	37.6	0.6	2,662	97.9	52.3	8.0
Other manufacturing	15	144.5	503.2	3.2	2,549	56.1	88.1	31.4
All sectors	494	295.2	190.8	7.0	78,655	79.3	67.2	21.3

Source: Constructed by the authors using data from the 1977 to 1991 rounds of the Colombian manufacturing census. Value added per worker is measured in thousands of pesos per year. Value added per unit of capital is measured as a fraction, over a one-year period.

4. Downsizing Episodes

For a reduction in employment to reflect a restructuring effort, it has to affect a substantial fraction of the plant's workforce, and a substantial number of workers, within a short period. To determine how substantial is substantial enough, some critical threshold has to be set. On the other hand, for the reduction to be considered durable, employment has to stay below its initial level for some time. Again, a critical threshold is needed to determine how far from the initial level is far enough. Rather than using two independent thresholds, this paper relies on one critical value, identified in what follows as N. It assumes that a plant experiences a downsizing episode if employment falls by at least N percent, and by no less than N workers, between one year and the next. In addition, employment has to recover by less than N-1 percent, and by less than N-1 workers, during the following year.

The dummy variable D_{it} is thus defined as follows:

$$D_{i,t} = 1 \text{ if } Log\,L_{i,t} - Log\,L_{i,t-1} < -\frac{N}{100},\ L_{i,t} - L_{i,t-1} < -N,$$

$$Log\,L_{i,t+1} - Log\,L_{i,t} < \frac{N-1}{100} \text{ and } L_{i,t+1} - L_{i,t} < (N-1)$$

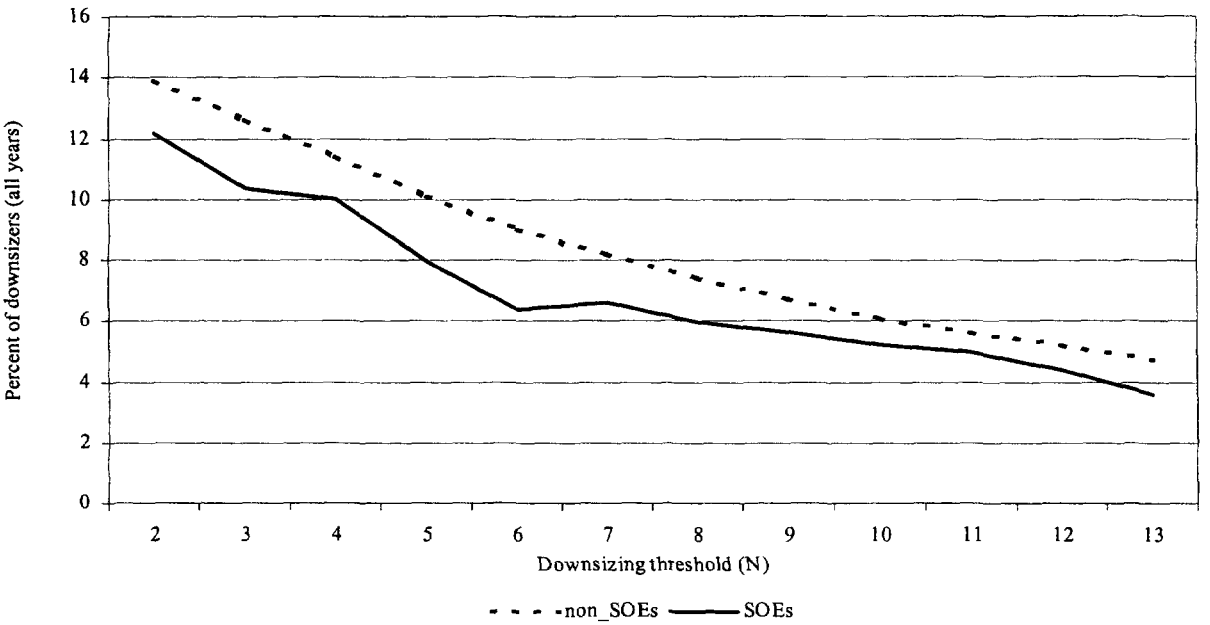
$$D_{i,t} = 0 \text{ otherwise} \qquad (8)$$

Based on this definition, the number of downsizing episodes should be larger the smaller is the critical threshold N.

Because the definition of a downsizing episode involves data on employment spanning three consecutive years, a row of three consecutive values of L_i can be treated as an observation. Figure 2 shows the percentage of all observations that are to be considered downsizers for different values of N. The figure confirms that this percentage is a downward-sloping function of N in the case of Colombia, both in the public and in the private sectors. But the function is not too steep in the private sector, and is remarkably flat in the public sector. In fact, all values of N between 6 and 10 yield roughly the same percentage of downsizers among state-owned enterprises: around 6 percent of all observations. The mid-point of this range (N = 8) is therefore used as the critical threshold in what follows.

According to Figure 2, downsizing is more common in the private sector than in the public sector. Table 3 shows that it also has different features. On average, public sector downsizing involves a smaller share of the workforce: 21.1 percent instead of 28.4 percent. However, state-owned enterprises tend to be larger, so that many more workers are affected in the public sector (110 instead of 36). The characteristics of the affected workers differ too. Table 4 reveals that females and the unskilled are on average under-represented among those who leave the public sector. But they are hugely overrepresented in the food sector. In the private sector, by contrast, there are no major differences between the characteristics of the workers affected by downsizing and those who remain in their workforce.

Figure 2. Downsizing Episodes as a Function of Downsizing Threshold



Source: Constructed by the authors using data from the 1977 to 1991 rounds of the Colombian manufacturing census.

Table 3. Downsizing Episodes

	State-owned enterprises			*Private enterprises*		
Sector of activity	*Percent of observations*	*Change in workers per firm*	*Percent change in workers per firm*	*Percent of observations*	*Change in workers per firm*	*Percent change in workers per firm*
Food	1.6	–10	–36.1	6.0	–39	–32.3
Beverages	5.0	–65	–19.4	11.0	–50	–21.5
Tobacco				12.5	–51	–20.1
Textiles	16.7	–20	–54.8	9.9	–56	–27.4
Clothing and shoes				7.8	–28	–29.5
Leather goods except shoes				7.8	–32	–27.3
Wood and cork products				4.6	–23	–34.0
Wood furniture				7.8	–23	–29.2
Paper and paper products				8.7	–27	–22.8
Printing and publishing	1.2	–12	–13.4	4.5	–38	–30.2
Chemicals				7.0	–37	–25.3
Petroleum derivatives	12.2	–357	–14.9	5.2	–24	–27.3
Rubber products				6.9	–32	–27.9
Nonmetallic minerals				7.3	–30	–27.1
Metals				7.1	–69	–28.6
Metal products				7.7	–27	–29.1
Nonelectrical machinery				6.6	–24	–29.4
Electrical machinery				9.6	–47	–24.5
Transport equipment	19.6	–42	–18.8	9.5	–42	–26.8
Other manufacturing				8.4	–27	–29.6
All sectors	6.0	–110	–21.1	7.4	–36	–28.4

Source: Constructed by the authors using data from the 1977 to 1991 rounds of the Colombian manufacturing census. Downsizing episodes are identified based on employment data spanning three consecutive years. A downsizing episode involves a decline in employment by 8 workers or more, and by 8 percent or more, from one year to the next. In addition, employment has to increase by less than 7 workers, and by less than 7 percent, in the following year.

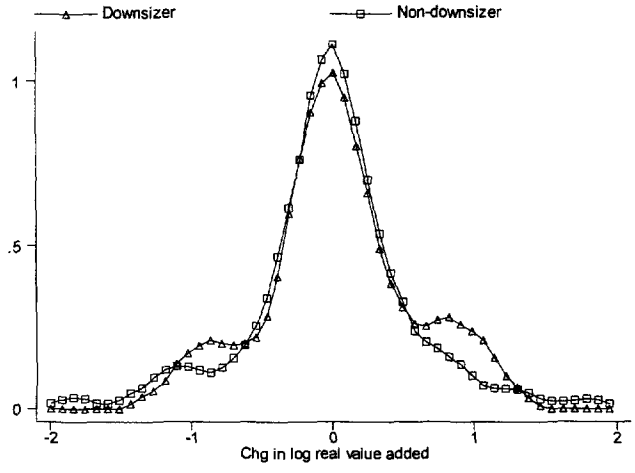
Table 4. Summary Statistics for Workers

	All workers						*Workers affected by downsizing*					
	State-owned enterprises			*Private enterprises*			*State-owned enterprises*			*Private enterprises*		
Sector of activity	*Percent of female workers*	*Percent of skilled workers*	*Percent of appren-tices*	*Percent of female workers*	*Percent of skilled workers*	*Percent of appren-tices*	*Percent of female workers*	*Percent of skilled workers*	*Percent of appren-tices*	*Percent of female workers*	*Percent of skilled workers*	*Percent of appren-tices*
Food	11.1	21.2	0.7	33.6	23.3	0.6	52.2	47.8	0.0	34.9	24.8	0.8
Beverages	36.2	31.8	2.4	17.9	38.4	1.8	37.1	36.4	2.8	14.6	44.3	2.6
Textiles	1.9	8.6	0.0	49.5	14.6	0.7	2.4	6.0	0.0	48.7	15	1.2
Printing and publishing	38.8	22.6	0.2	34.3	20.9	0.9	32.1	47.6	2.4	35.8	25.9	1.3
Chemicals	6.6	21.6	0.0	35.4	32.0	0.9				38.9	34.4	1.4
Petroleum derivatives	8.8	12.4	2.2	12.5	21.7	0.4	7.1	1.9	2.9	10.5	19.9	0.0
Nonmetallic minerals	14.8	19.3	0.0	15.1	13.9	0.7				17.4	16	0.7
Nonelectrical machinery	3.3	10.0	6.7	14.7	17.3	0.9				16.0	21.9	1.3
Transport equipment	0.6	6.4	0.0	14.8	16.6	1.0	0.8	6.3	0.0	15.5	19.8	1.3
Other manufacturing	17.3	39.2	1.4	41.5	18.5	0.6				43.9	21.1	0.7
All sectors	25.8	24.2	1.4	35.6	18.5	0.8	18.2	19.2	1.7	37.5	20.9	1.0

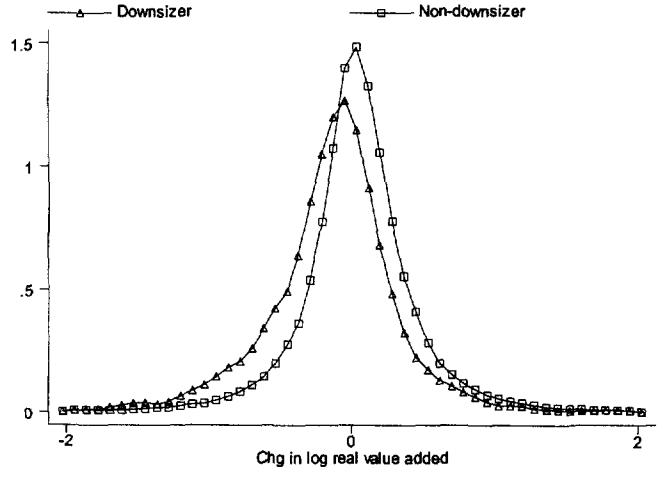
Source: Constructed by the authors using data from the 1977 to 1991 rounds of the Colombian manufacturing census.

Figures 3 to 5 display the distribution of the productivity gains dy, d(y/l) and d(y/k) across state-owned and privately owned enterprises. In each case, the distinction is made between downsizers and nondownsizers. The most striking difference between these two groups concerns d(y/l). Figure 4 shows that value added per workers grows substantially more in downsizers than in nondownsizers. If anything, the gap is larger in the public sector than in the private sector. The patterns are slightly different for the other two productivity indicators. Value added per unit of capital grows faster among downsizers in the public sector.

Figure 3. Distribution of Annual Changes in Value Added



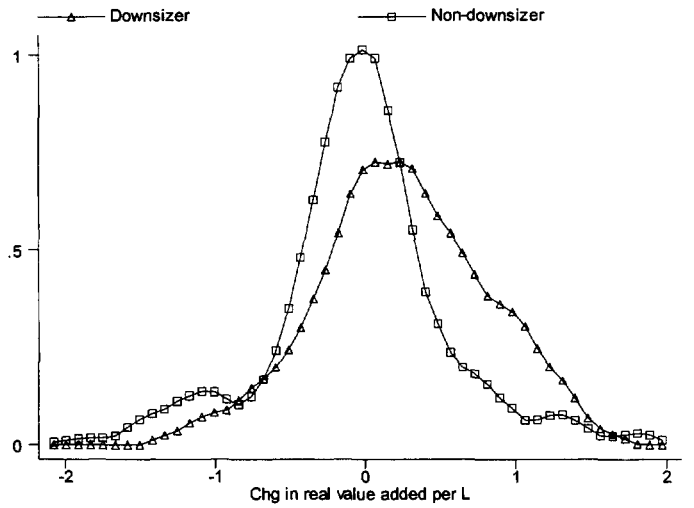
Panel (a) State-owned enterprises



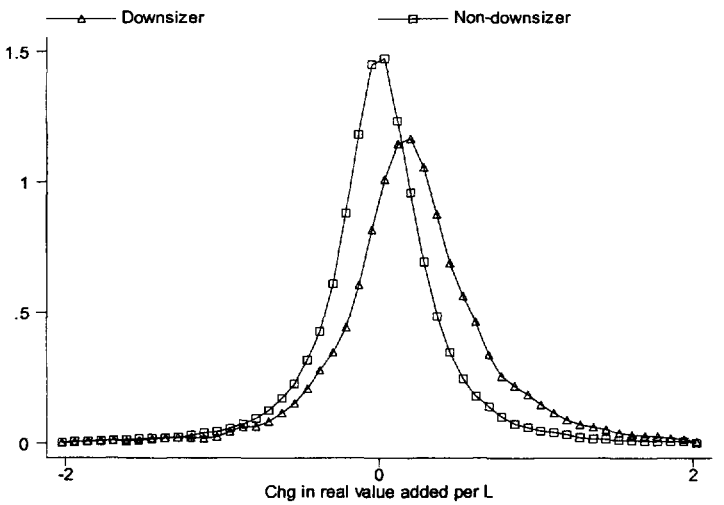
Panel (b) Private enterprises

Source: Constructed by the authors using data from the 1977 to 1991 rounds of the Colombian manufacturing census. The density functions were drawn using Epanechnikov kernels with optimal width. Changes in value added per worker are measured in logs.

Figure 4. Distribution of Annual Changes in Value Added per Worker



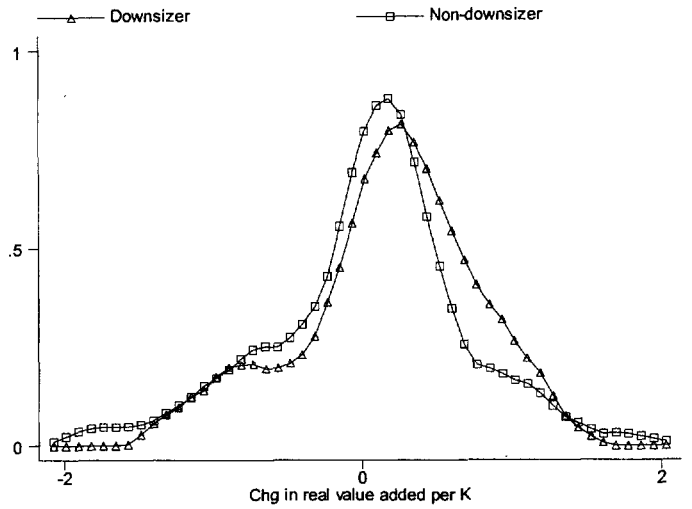
Panel (a) State-owned enterprises



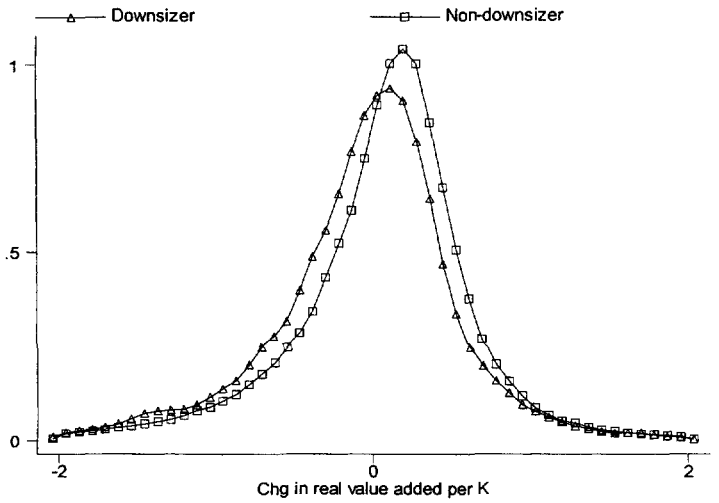
Panel (b) Private enterprises

Source: Constructed by the authors using data from the 1977 to 1991 rounds of the Colombian manufacturing census. The density functions were drawn using Epanechnikov kernels with optimal width. Changes in value added per worker are measured in logs.

Figure 5. Distribution of Annual Changes in Value Added per Unit of Capital



Panel (a) State-owned enterprises



Panel (b) Private enterprises
Downsizing observations and nondownsizing observations

Source: Constructed by the authors using data from the 1977 to 1991 rounds of the Colombian manufacturing census. The density functions were drawn using Epanechnikov kernels with optimal width Changes in value added per unit of capital are measured in logs.

5. Main Results

The determinants of annual changes in productivity are analyzed in Tables 5 to 7. Each of these tables focuses on one of the three productivity indicators chosen: annual change in total value added, annual change in value added per worker, and annual changes in value added per capital, respectively. Two sets of regression results are reported for each indicator. One of them, in the tables identified with the letter "a," corresponds to the specification in equation (4). The other set, identified with the letter "b," corresponds to the specification in equation (5). The latter set relies on smaller samples, but the corresponding regressions include plant-specific effects. If downsizing episodes are not correlated with unobservable characteristics of the enterprises, the estimates in the "a" tables are preferable, because of their higher precision. If they are correlated, however, the estimates in the "b" tables are more reliable, because they are unbiased.

The sets of regressions in Tables 5 to 7 also differ in the control variables considered. The specification in the first column is the most parsimonious. It only includes the state-ownership dummy, the downsizing dummy, and their interaction. Subsequent columns control for the initial "size" of the enterprise (in terms of capital stock, employment level or both), sector, province and year effects. The last two columns take into account the environment in which enterprises operate, measured at the sector level. The control variables considered here refer to the degree of competition in product markets and the tax burden.

The extent of product market competition is captured by the Herfindahl index, which is a standard measure of industry concentration. The index is higher the more concentrated the industry. In the Colombian data set, it varies from 0.79 to 69.43, with an average of 4.38. Another measure of product market competition is the export orientation of the sector, which is computed as the ratio of total exports to total output. The more export-oriented is a sector, the stronger the competitive pressures it faces. In the Colombian data set, the export orientation variable ranges from zero to 0.242, with an average of 0.027. Unfortunately, data on exports were missing for many observations, thus reducing the sample size substantially. This is why the export orientation variable was only used in the last column of Tables 5 to 7.

A similar problem arises with the tax burden. The ideal measure in this respect is the average tax rate at the sector level, computed as the difference between taxes and subsidies divided by value added. But again, information on subsidies was missing for a large number of observations. Hence the construction of two separate variables, one for taxes and one for subsidies, with the latter only entering the regressions in the last column of Tables 5 to 7. In the Colombian data set, the average tax rate is 18.1 percent, and the average subsidy rate 2.5 percent.

Tables 5a and 5b show that downsizing is associated with a large drop in value added in private enterprises. This drop is estimated at roughly 15 to 20 percentage points, regardless of the econometric method and the set of control variables used. However, there is a very significant difference between private enterprises and state-owned enterprises. The coefficient multiplying the interaction term between downsizing and state ownership (α_3 in equation 4, or β_3 in equation 5) is indeed positive, and close to 30 percent. This means that value added actually grows in state-owned enterprises that downsize. Tables 5a and 5b also reveal interesting information regarding other determinants of annual growth in value added. Other things equal, productivity growth is lower in state-owned enterprises and in more concentrated industries. It is slightly higher in large enterprises.

Table 5a. Determinants of Annual Changes in Value Added OLS Estimates

	Dependent variable: Change in the log of value added					
State-owned enterprise	–0.083***	–0.127***	–0.067***	–0.099***	–0.099***	–0.096***
	(–3.46)	(–5.30)	(–2.75)	(–4.08)	(–4.11)	(–3.56)
Downsizing episode	–0.191***	–0.211***	–0.180***	–0.200***	–0.200***	–0.198***
	(–27.10)	(–29.84)	(–25.85)	(–28.65)	(–28.64)	(–25.22)
State owned x downsizing	0.266***	0.265***	0.267***	0.264***	0.260***	0.206***
	(2.73)	(2.73)	(2.78)	(2.77)	(2.74)	(2.04)
Log of initial capital stock		0.006***		0.006***	0.006***	0.006***
		(4.11)		(4.50)	(4.47)	(3.78)
Log of initial employment		0.022***		0.023***	0.023***	0.026***
		(8.90)		(9.04)	(9.04)	(9.00)
Sector Herfindahl					–0.004***	–0.004***
					(–4.16)	(–3.30)
Sector export orientation						0.059
						(0.25)
Sector tax rate					–0.0001	–0.027
					(–1.60)	(–1.36)
Sector subsidy rate						0.003
						(0.14)
Sector dummies	No	No	Yes	Yes	Yes	Yes
Province dummies	No	No	Yes	Yes	Yes	Yes
Year dummies	No	No	Yes	Yes	Yes	Yes
Adjusted R^2	0.009	0.013	0.045	0.050	0.050	0.054
F-test	247.6	213.9	88.3	92.3	88.8	79.4
Number of observations	79,149	78,717	79,149	78,717	78,717	63,246

Source: Constructed by the authors using data from the 1977 to 1991 rounds of the Colombian manufacturing census. All regressions were estimated by ordinary least-squares; t-values are reported in parentheses. Significant coefficients at the 10, 5, and 1 percent level are indicated by one, two and three asterisks, respectively.

Table 5b. Determinants of Annual Changes in Value Added Fixed Effects Estimates

	Dependent variable: Change in the log of value added					
Downsizing episode	–0.160***	–0.152***	–0.154***	–0.146***	–0.146***	–0.142***
	(–20.55)	(–19.54)	(–20.17)	(–19.23)	(–19.20)	(–16.50)
State owned x downsizing	0.305***	0.314***	0.292***	0.299***	0.295***	0.243***
	(2.86)	(2.98)	(2.80)	(2.90)	(2.86)	(2.16)
Log of initial capital stock		0.019***		0.015***	0.014***	0.015***
		(6.30)		(5.02)	(4.74)	(4.37)
Log of initial employment		0.172***		0.162***	0.163***	0.176***
		(24.60)		(23.59)	(23.63)	(21.86)
Sector Herfindahl					–0.007***	–0.006***
					(–7.05)	(–5.74)
Sector export orientation						0.210
						(0.89)
Sector tax rate					–0.0003**	–0.052***
					(–2.90)	(–2.51)
Sector subsidy rate						0.022
						(0.93)
Sector dummies	No	No	No	No	No	No
Province dummies	No	No	No	No	No	No
Year dummies	No	No	Yes	Yes	Yes	Yes
Within R^2	0.006	0.018	0.051	0.061	0.020	0.057
F-test	212.1	305.2	305.2	251.9	228.4	174.3
Number of observations	77,258	76,831	77,258	76,831	76,831	61,587

Source: Constructed by the authors using data from the 1977 to 1991 rounds of the Colombian manufacturing census. All regressions were estimated using fixed effects estimators; t-values are reported in parentheses. Significant coefficients at the 10, 5, and 1 percent level are indicated by one, two and three asterisks, respectively.

Downsizing is also associated with a substantial increase in value added per worker. In Tables 6a and 6b the coefficient multiplying the downsizing dummy fluctuates in the range of 20 to 25 percentage points. Again, the result is basically independent of the econometric method used, and the set of control variables considered. But this time the difference between private enterprises and state-owned enterprises is statistically insignificant. Also, the results in Tables 6a and 6b support the view that productivity growth is lower in the public sector and in more concentrated industries. The significance of the coefficients on the export orientation and taxation variables depends on the econometric method and the specification chosen. Based on the fixed effects results, a heavy tax burden could be associated with a lower growth rate of value added per worker.

Table 6a. Determinants of Annual Changes in Value Added per Worker OLS Estimates

	Dependent variable: Change in the log of value added per worker					
State-owned enterprise	–0.062***	–0.074***	–0.048***	–0.057***	–0.057***	–0.042
	(–2.56)	(–3.06)	(–1.94)	(–2.31)	(–2.34)	(–1.54)
Downsizing episode	0.217***	0.210***	0.227***	0.220***	0.220***	0.221***
	(30.74)	(29.65)	(32.35)	(31.24)	(31.24)	(28.00)
State owned x downsizing	0.088	0.090	0.090	0.091	0.088	0.005
	(0.91)	(0.92)	(0.94)	(0.95)	(0.92)	(0.05)
Log of initial capital stock		0.004***		0.004***	0.005***	0.006***
		(4.70)		(4.79)	(4.75)	(5.07)
Sector Herfindahl					–0.004***	–0.003***
					(–3.23)	(–2.13)
Sector export orientation						–0.469***
						(–1.96)
Sector tax rate					–0.000	–0.013
					(–0.06)	(–0.65)
Sector subsidy rate						0.010
						(0.44)
Sector dummies	No	No	Yes	Yes	Yes	Yes
Province dummies	No	No	Yes	Yes	Yes	Yes
Year dummies	No	No	Yes	Yes	Yes	Yes
Adjusted R^2	0.012	0.012	0.044	0.044	0.044	0.048
F-test	320.4	242.1	85.6	83.7	80.3	71.3
Number of observations	79,138	78,706	79,138	78,706	78,706	63,239

Source: Constructed by the authors using data from the 1977 to 1991 rounds of the Colombian manufacturing census. All regressions were estimated by ordinary least-squares; t-values are reported in parentheses. Significant coefficients at the 10, 5, and 1 percent level are indicated by one, two and three asterisks, respectively.

As regards value added per unit of capital, it does decline in private enterprises that downsize. In Tables 7a and 7b, the point estimate for this decline is around 10 to 15 percentage points, regardless of the econometric method and control variables used. State-owned enterprises, however, could experience an increase in value added per unit of capital as a result of downsizing. The coefficient on the interactive term has roughly the same size (20 to 25 percentage points) in all specifications, and is statistically significant in most of them. Almost all of the other potential determinants of productivity growth appear to be irrelevant. The only exception is the initial size of the enterprise, which shows a positive association with the annual change in value added per unit of capital.

Table 6b. Determinants of Annual Changes in Value Added per Worker Fixed Effects Estimates

	Dependent variable: Change in the log of value added per worker					
Downsizing episode	0.252***	0.246***	0.260***	0.255***	0.255***	0.256***
	(31.86)	(31.22)	(33.32)	(32.76)	(32.80)	(29.05)
State owned x	0.123	0.131	0.105	0.111	0.107	0.038
downsizing	(1.14)	(1.21)	(0.99)	(1.05)	(1.01)	(0.33)
Log of initial capital		0.024***		0.022***	0.021***	0.021***
stock		(8.08)		(7.31)	(7.06)	(6.19)
Sector Herfindahl					–0.006***	–0.005***
					(–5.94)	(–4.68)
Sector export						0.007
orientation						(0.03)
Sector tax rate					0.0001	–0.046**
					(–1.10)	(–2.18)
Sector subsidy rate						0.018
						(0.73)
Sector dummies	No	No	No	No	No	No
Province dummies	No	No	No	No	No	No
Year dummies	No	No	Yes	Yes	Yes	Yes
Within R^2	0.015	0.016	0.050	0.050	0.039	0.051
F-test	513.5	356.4	230.2	216.7	194.7	164.1
Number of						
observations	77,243	76,816	77,243	76,816	76,816	61,577

Source: Constructed by the authors using data from the 1977 to 1991 rounds of the Colombian manufacturing census. All regressions were estimated using fixed effects estimators; t-values are reported in parentheses. Significant coefficients at the 10, 5, and 1 percent level are indicated by one, two and three asterisks, respectively.

To summarize, downsizing episodes in the private sector are associated with a decline in total value added, an increase in value added per worker and a decline in value added per unit of capital. Downsizing episodes in the public sector, on the other hand, are associated with an increase in all three productivity indicators.

The differences between the outcomes in the two sectors could be partly due to the fact that downsizing entails larger employment cuts, in relative terms, in the private sector (see Table 2). Political considerations could make mass layoffs more difficult in the public sector. More drastic labor restructuring in the private sector could account for both the decline in total value added and the increase in value added per worker. But differences between the two sectors would also be consistent with a higher level of initial inefficiency in the state-owned enterprises (see Figure 1). In particular, outdated work practices and poor monitoring could be kept for much longer than in the private sector. Public sector downsizing could therefore be associated with a move towards the technology frontier, and not just with a move along that frontier.

Table 7a. Determinants of Annual Changes in Value Added per Unit of Capital OLS Estimates

	Dependent variable: Change in the log of value added per unit of capital					
State-owned enterprise	–0.040	–0.036	–0.037	–0.035	–0.035	–0.65**
	(–1.22)	(–1.10)	(–1.11)	(–1.03)	(–1.02)	(–1.71)
Downsizing episode	–0.127***	–0.126***	–0.123*** (–	–0.121***	–0.121***	–0.125***
	(–13.19)	(–12.88)	12.71)	(–12.43)	(–12.43)	(–11.34)
State owned x	0.279***	0.280***	0.263***	0.263***	0.264***	0.225
downsizing	(2.09)	(2.09)	(1.98)	(1.99)	(2.00)	(1.59)
Log of initial		–0.003		–0.003	–0.003	–0.002
employment		(–1.26)		(–1.25)	(–1.24)	(–0.72)
Sector Herfindahl					0.0003	–0.0006
					(0.24)	(–0.38)
Sector export						–0.082
orientation						(–0.02)
Sector tax rate					–0.0001	0.0001
					(–1.04)	(0.01)
Sector subsidy rate						0.028
						(0.88)
Sector dummies	No	No	Yes	Yes	Yes	Yes
Province dummies	No	No	Yes	Yes	Yes	Yes
Year dummies	No	No	Yes	Yes	Yes	Yes
Adjusted R^2	0.002	0.002	0.024	0.024	0.024	0.028
F-test	58.6	44.4	45.6	44.6	42.7	40.8
Number of						
observations	78,657	78,657	78,657	78,657	78,657	63,206

Source: Constructed by the authors using data from the 1977 to 1991 rounds of the Colombian manufacturing census. All regressions were estimated by ordinary least-squares; t-values are reported in parentheses. Significant coefficients at the 10, 5, and 1 percent level are indicated by one, two and three asterisks, respectively.

Table 7b. Determinants of Annual Changes in Value Added per Unit of Capital Fixed Effects Estimates

	Dependent variable: Change in the log of value added per unit of capital					
Downsizing episode	–0.110 *** (–10.15)	–0.102*** (–9.47)	–0.105*** (–9.77)	–0.099*** (–9.15)	–0.099*** (–9.15)	–0.106*** (–8.64)
State owned x downsizing	0.253** (1.71)	0.254** (1.72)	0.227 (1.56)	0.228 (1.56)	0.228 (1.56)	0.202 (1.26)
Log of initial employment		0.088*** (9.21)		0.086*** (9.09)	0.086*** (9.12)	0.088*** (7.81)
Sector Herfindahl					0.0004 (0.33)	0.0002 (0.16)
Sector export orientation						–0.106 (–0.32)
Sector tax rate					–0.0002 (–1.66)	0.020 (0.67)
Sector subsidy rate						0.036 (1.06)
Sector dummies	No	No	No	No	No	No
Province dummies	No	No	No	No	No	No
Year dummies	No	No	Yes	Yes	Yes	Yes
Within R^2	0.002	0.003	0.026	0.028	0.028	0.031
F-test	52.0	62.9	118.7	116.6	103.8	96.7
Number of observations	76,773	76,773	76,773	76,773	76,773	61,545

Source: Constructed by the authors using data from the 1977 to 1991 rounds of the Colombian manufacturing census. All regressions were estimated using fixed effects estimators; t-values are reported in parentheses. Significant coefficients at the 10, 5, and 1 percent level are indicated by one, two and three asterisks, respectively.

6. Does Market Structure Matter?

Initial efficiency could be lower in state-owned enterprises if the latter were sheltered from product market competition in one way or another. From this perspective, the potential productivity gains from downsizing could be higher in activities that are highly concentrated, or not exposed to export markets. In terms of the analytical section above, this difference between state-owned and privately owned enterprises should be reflected in coefficients α_6 in equation (6), and β_6 in equation (7). These are the coefficients multiplying the interactive terms on ownership (S_i), downsizing (D_{it}) and market structure (M_{it}). If these coefficients were statistically different from zero, public sector downsizing would be more conducive to higher productivity in some market environments than in others.

However, exposure to competitive forces could also have an impact on productivity gains in "normal" periods. In the absence of major restructuring endeavors, state-owned enterprises could be unable to keep pace with private enterprises in highly competitive markets. Political pressures and insider power could make the public sector particularly ill-suited to activities requiring a rapid adjustment to changing demand. As a result, productivity growth in nondownsizing years could be slower than in the private sector. In analytical terms, coefficients α_4 and β_4 would be different from zero. These are the coefficients multiplying the interactive terms on ownership (S_i) and market structure (M_{it}).

The regressions in Tables 8 and 9 aim at testing the hypothesis that market structure matters. These Tables report estimates for the key coefficients in equations (6) and (7), for two indicators of product market competition. In the regressions in Table 8, M_{it} is measured by the Herfindahl index at the sector level. In the regressions in Table 9, it is measured by the export orientation index, also defined at the sector level. All other control variables are the same as in the last columns of Tables 5, 6 and 7. This means that only two regression results are reported for each of the productivity indicators: one relying on ordinary least squares and using the maximum number of observations, the other one relying on fixed effects estimators and focusing on plants that are observed at least twice in the data set.

The results in these tables suggest that the productivity gains from public sector downsizing do not depend on the extent of competition in product markets. None of the estimates for coefficients α_6 or β_6 is statistically different from zero, regardless of the product market indicator used.

However, productivity gains in nondownsizing years do depend on the extent of product market competition. Coefficients α_6 and β_6 are significantly negative when the extent of competition is measured by the export orientation of the activity. State-owned enterprises exhibit much lower productivity gains than their private sector counterparts in activities that are exposed to world markets. The results are more mixed when the extent of competition is measured by the Herfindahl index, as the sign of coefficients α_6 and β_6 depends on the econometric technique used. The fixed effects estimates should be more reliable, as they are not affected by selection bias. Based on these estimates, state-owned enterprises exhibit higher productivity gains than their private sector counterparts in concentrated markets.

The regression analyses in Tables 8 and 9 could probably be refined. In the meantime, the results should be treated with caution. Those results tentatively suggest that state-owned enterprises perform poorly in highly competitive markets. But trying to improve their performance by restricting competition could reduce the overall efficiency of the economy, and adversely affect the well-being of the population. On the other hand, the

results in Tables 8 and 9 also suggest that the basic differences between public sector downsizing and private sector downsizing that were identified in the previous section stand for enterprises operating in both competitive and uncompetitive market structures.

Table 8. Industry Concentration and Productivity Gains from Downsizing

	Dependent variable: Change in the log of value added					
	Total		*per worker*		*per unit of capital*	
	OLS	*FE*	*OLS*	*FE*	*OLS*	*FE*
State-owned	–0.040		0.005		–0.003	
enterprise	(–1.18)		(0.16)		(–0.07)	
Downsizing	–0.210***	–0.159***	0.219***	0.251***	–0.128***	–0.114***
episode	(–20.16)	(–13.80)	(20.86)	(21.35)	(–8.75)	(–6.94)
State owned x	0.778	0.169	–0.128	–0.037	0.026	0.015
downsizing	(0.55)	(1.07)	(–0.89)	(–0.23)	(0.13)	(0.07)
Sector	–0.004***	–0.007***	–0.002*	–0.006***	–0.000	–0.000
Herfindahl	(–3.17)	(–6.34)	(–1.93)	(–5.12)	(–0.22)	(–0.08)
Downsizing x	0.003*	0.004**	0.000	0.001	0.001	0.002
Herfindahl	(1.85)	(2.17)	(0.21)	(0.61)	(0.36)	(0.71)
State owned x	–0.007***	0.016***	–0.006**	0.015**	–0.008**	0.006
Herfindahl	(–2.79)	(2.72)	(–2.33)	(2.50)	(–2.18)	(0.78)
State owned x						
downsizing x	0.010	0.003	0.011	0.005	0.016	0.012
Herfindahl	(1.31)	(0.39)	(1.51)	(0.61)	(1.57)	(1.06)
Other control variables as in last column of						
Table	5a	5b	6a	6b	7a	7b
Adjusted R^2 /						
Within R^2	0.054	0.057	0.048	0.051	0.028	0.031
F-test	74.8	150.0	67.0	139.9	38.4	82.3
Number of						
observations	63,246	61,587	63,239	61,577	63,206	61,545

Source: Constructed by the authors using data from the 1977 to 1991 rounds of the Colombian manufacturing census. Regressions in the first, third and fifth columns were estimated using ordinary least squares. Those in the second, fourth and sixth column were estimated using fixed effects. t-values are reported in parentheses. Significant coefficients at the 10, 5, and 1 percent level are indicated by one, two and three asterisks, respectively.

Table 9. Export Orientation and Productivity Gains from Downsizing

	Dependent variable: Change in the log of value added					
	Total		*per worker*		*per unit of capital*	
	OLS	*FE*	*OLS*	*FE*	*OLS*	*FE*
State-owned enterprise	0.030		0.070*		0.012	
	(0.77)		(1.80)		(0.21)	
Downsizing episode	–0.200***	–0.156***	0.194***	0.225***	–0.129***	–0.112***
	(–15.48)	(–10.97)	(14.91)	(15.42)	(–7.09)	(–5.50)
State owned x downsizing	0.104	0.145	–0.068	–0.033	0.034	0.004
	(0.67)	(0.86)	(–0.44)	(–0.19)	(0.16)	(0.02)
Sector export orientation	0.082	0.270	–0.457*	0.041	–0.069	–0.036
	(0.34)	(1.14)	(–1.91)	(0.17)	(–0.21)	(–0.11)
Downsizing x export	0.109	0.541	1.043***	1.243***	0.164	0.214
	(0.27)	(1.21)	(2.57)	(2.72)	(0.29)	(0.34)
State owned x export	–7.710***	–28.46***	–6.925***	–28.56***	–4.721**	–27.76***
	(–4.55)	(–6.87)	(–4.06)	(–6.73)	(–1.99)	(–4.70)
State owned x downsizing	6.147	–1.403	5.000	–2.805	12.601	5.563
x export	(0.77)	(–0.16)	(0.62)	(–0.32)	(1.13)	(0.45)
Other control variables as						
in last column of Table	5a	5b	6a	6b	7a	7b
Adjusted R^2	0.054	0.058	0.048	0.052	0.028	0.031
F-test	74.9	151.8	67.3	142.3	38.4	83.3
Number of observations	63,246	61,587	63,239	61,577	63,206	61,545

Source: Constructed by the authors using data from the 1977 to 1991 rounds of the Colombian manufacturing census. Regressions in the first, third and fifth columns were estimated using ordinary least squares. Those in the second, fourth and sixth column were estimated using fixed effects. t-values are reported in parentheses. Significant coefficients at the 10, 5, and 1 percent level are indicated by one, two and three asterisks, respectively.

7. Conclusions

This paper uses a unique data set to assess the productivity impact of public sector downsizing in a developing country. The restructuring of public sector enterprises has been one of the main areas of policy activism in developing countries and transition economies in recent years. And it is bound to remain important in the near future. While privatization could be preferable, it might not be a viable option, both for economic and political reasons. Unfortunately, very little is known about the actual impact of downsizing on the productivity of state-owned enterprises. To our knowledge, our paper is the first one to address this issue based on an empirical analysis, and not on simulations.

The results of this empirical analysis suggest that the productivity gains from downsizing may be larger in state-owned enterprises than in private enterprises. While the increase in value added per worker is similar in both cases, state-owned enterprises

experience an increase in total value added, and in value added per unit of capital, whereas both indicators decline in private enterprises. But the difference could be simply due to the larger extent of initial inefficiency in state-owned enterprises. Quite unexpectedly, this difference does not appear to depend on the degree of competition in product markets.

Several important caveats apply. To begin with, our results refer to downsizing in a specific developing country over a specific period of time, and may not be replicable elsewhere. The results indicate that public sector downsizing did increase productivity substantially in that country and period; not that it will always increase productivity. If anything, the experience of Colombia implies that appropriate instruments to process mass job separations should be made available to the state-owned enterprises that need to restructure their operations. Not that public sector downsizing should become a goal of economic policy.

Caution should also be exercised when assessing the implications of our results for privatization. The results in this paper suggest that enterprise restructuring, including labor downsizing, can serve a useful purpose in preparation to privatization. The magnitude of the productivity gains observed in Colombia could be large enough to make state-owned enterprises profitable, hence attractive to prospective bidders. But it is not clear that the productivity gains would be large enough to justify the operation, from an economic point of view. The resulting increase in privatization price could not be large enough to compensate the costs associated with downsizing, and in particular with mass job separations.

Moreover, the paper shows that in "normal" years, productivity gains are larger in private enterprises than in state-owned enterprises. It also appears that state-owned enterprises are particularly ill-suited to operate in a highly competitive environment, characterized by low concentration or substantial exposure to world markets. Even if public sector downsizing can improve the performance of state-owned enterprises in the short run, in the long run private enterprises seem to do better. From this perspective, public sector restructuring, including labor downsizing, would only be a second best when privatization is a viable option.

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